



This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

- + *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
- + *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
- + *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
- + *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at <http://books.google.com/>

Med
1760
9

Med 1760.9



Harvard College Library

FROM

The Author

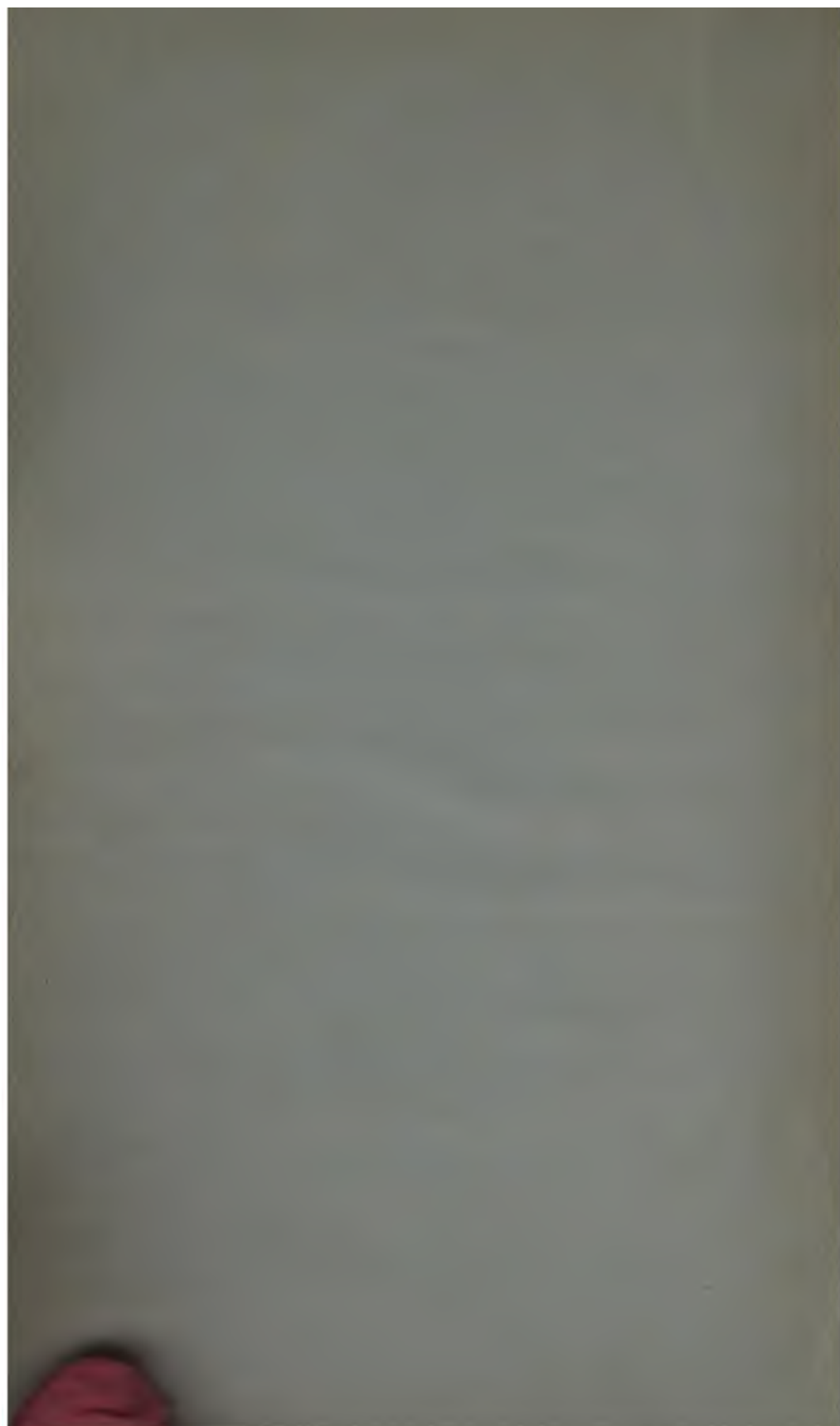
20 Dec 1898

Med 1760.9
~~V. 6059~~

*The Causes and Conditions of Pulmonary
Tuberculosis, and How to Avoid Them.*

BY
^{Dezord}
EDWARD O. OTIS, M.D.,
PRESIDENT OF THE AMERICAN CLIMATOLOGICAL ASSOCIATION.

FROM
THE AMERICAN JOURNAL OF THE MEDICAL SCIENCES,
NOVEMBER, 1898.



Med 1760.7

~~V. 6059~~



Extracted from The American Journal of Medical Sciences, November, 1898.

The Author

THE CAUSES AND CONDITIONS OF PULMONARY TUBERCULOSIS, AND HOW TO AVOID THEM.¹

BY EDWARD O. OTIS, M.D.,
Original

PRESIDENT OF THE AMERICAN CLIMATOLOGICAL ASSOCIATION.

THAT instinct which prompts us to regard all men mortal but ourselves has, doubtless, its salutary influence in that it conduces to a more placid endurance of the "chances and changes of this mortal life." On the other hand, however, it is likely to beget in us a carelessness in regard to many of the avoidable dangers to life, particularly when these dangers are ever present with us, breeding a dangerous contempt from our constant familiarity with them. It is always useful, and in season then, to cry "memento mori" with regard to any of the great and constantly present risks to human life, with the hope that we may become more keenly conscious of them, and incited to employ any and all precautions against them. Prevention is always more satisfactory than cure, and the attempt more inspiring. In it the physician exhibits the highest aim and ideal of his unselfish art. From a mercenary point of view, moreover, the cost of prevention is far below that of attempts at cure.

One and probably the greatest danger which threatens human life at the present time is pulmonary tuberculosis; either directly or indirectly it touches the life of almost every individual; one-half of the human race suffer from it, and its ravages are as wide as the habitable world. The mortality from it approaches that of smallpox a hundred years ago, causing from one-fifth to one-seventh of all the deaths—"more than smallpox, diphtheria, scarlatina, typhoid fever, typhus fever, yellow fever, cerebro-spinal fever, Asiatic cholera, relapsing fever, leprosy, measles, and whooping-cough combined."² Moreover, its greatest number of victims is among the very young and those in the prime of life. Holsti³ has shown that the mortality is greatest during the first two years of life; the least from the ages of five to fifteen; and then it rises steadily until between thirty-one and forty

¹ An essay to which was awarded the "Pray" prize for 1897 of the New Hampshire Medical Society for "the best original essay upon some medical topic."

² Bergy: "Bovine Tuberculosis," etc. Medical News, January 23, 1897.

³ Annual of Universal Medical Sciences. Sajous, 1894.

years. Those whom it does not destroy it incapacitates for labor. We know now that consumption is curable, but at the best only a comparatively small per cent. are cured or permanently arrested, and those generally in the incipient stages and under the most favorable hygienic and climatic conditions. That we shall ever be able to cure any large number of cases by antitubercle serum seems to me problematic, for when the disease is once thoroughly established the infection becomes a mixed one, and various other micro-organisms are brought into play, and the whole system becomes involved. How early in the disease this happens we know not; but often, I believe, before the patient or his physician suspects or has detected the original bacillary infection.

From every point of view, then, the most hopeful outlook in combating this disease is by prevention, and in order to work effectively in this direction one must be familiar with the causes and conditions which lead up to it. To produce a case of pulmonary tuberculosis two factors are always essential: the bacillus and a favorable soil. All of us, especially in the city, are repeatedly exposed, I doubt not, to the tubercle bacillus, and yet those only are infected who present favorable conditions for the development of the germ. On the other hand, no matter how susceptible the individual or how small the "resistance potential," how unfavorable the climate or hygienic conditions may be, if the specific micro-organism is absent, tuberculosis is impossible. Brehmer,¹ who wrote many years before Koch's discovery of the tubercle bacillus, gives an interesting account of the inhabitants of Iceland, among whom pulmonary tuberculosis did not then exist. These people, he says, lived under the most unfavorable and unhygienic conditions. The winter was long and dreary, the sky cloudy, and the atmosphere filled with dampness. Their dwellings were small, dirty, dark, and unventilated, each person having scarcely ninety-nine cubic feet of air to breathe. These abodes were filled with foul-smelling vapor, arising from the débris of fish lying about the door, and the smoke from dried dung which constituted their fuel. Their food consisted mainly of dried fish which had begun to putrefy, a preparation of milk, called "sky," large quantities of rancid butter, and sour whey mixed with water; they also drank large quantities of alcohol. Their occupation was one of exposure in fishing, bird hunting, and sheep- and cattle-herding. Their feet were constantly wet. In spite of this extraordinarily unwholesome and pernicious condition of existence, no case of pulmonary tuberculosis existed. In seeking an explanation for this absence, Brehmer suggests the ingenious theory of a physiological augmentation of the circulation, with the resulting increased metabolism, and, perhaps, increased development of body heat produced by the use of an enormous quantity of

¹ Die Chronische Lungenschwindsucht und Tuberculose der Lunge, 1869.

fat, daily use of whey, and the extreme physical exertion incident to their occupation. The true explanation, of course, was that the tubercle bacilli have never been carried there. Whenever any of the Icelanders migrated to the mainland of Denmark, phthisis was extraordinarily frequent among them, as one would expect, for then occurred the union of the favorable soil from Iceland with the bacillus existing in Denmark.

Dr. Frederick A. Cook,¹ who accompanied Lieutenant Peary's Arctic Expedition, says that the Esquimaux of South Greenland are subject to tuberculosis in great numbers; and he estimates that two-thirds of the inhabitants suffer from some form of this disease. In the Arctic highlands, however, where Peary wintered, no case of tuberculosis was found. Also, upon the shores of Northwest Greenland, Dr. Cook found a small tribe of Esquimaux completely isolated on all sides by the glaciers and through a superstitious belief that the interior was inhabited by men and animals of gigantic size, and among these people tuberculosis had never been observed. Probably similar hygienic and climatic conditions existed in both cases; but the bacillus had been carried to South Greenland and had not reached the other localities.

To prevent tuberculosis, then, we must lead our efforts in two directions, that of eliminating the bacillus and that of establishing an immunity from it by promoting a normal standard of health. That we shall ever succeed in exterminating the elusive and ubiquitous bacillus appears now to be a chimerical fancy; but proof is already at hand that its wanderings can be restrained and its baleful influence curtailed. Italy, by methods of prevention,² reduced the mortality from this disease in less than a century from that of a most virulent epidemic to a comparatively rare disease; and England, by establishing special hospitals for its treatment and the consequent isolation of its tuberculous poor, reduced its mortality 50 per cent. in forty years; Philadelphia has reduced the mortality about 20 per cent. in eight years; and in New York City it has been reduced more than 30 per cent. in twelve years.

The specific germ—the tubercle bacillus—comes from tuberculous individuals, from the milk of tuberculous cows, from the flesh of infected cattle, and, in rare cases, from other domestic animals. Chiefly, however, the source of the germ is from tuberculous man, and from the dried sputum. The bacillus gains entrance into the body through the mucous membrane of the respiratory and digestive tracts, and by the skin. By far the most common entrance is through the respiratory tract, the bacillus being held in suspension in the air and entering the

¹ *Revue de la Tuberculose*, 2, 1894, p. 376.

² Flick: "Practical Measures for the Prevention of Tuberculosis." *The Medical Record*, October 21, 1893.

lungs through respiration. Congenital tuberculosis—direct transmission from mother to child—is possible, but so rare that it can be disregarded. It may be possible, also, that the bacillus may be conveyed directly by the breath; but in most, if not all, of the cases in which this appears to take place, the true source is probably the dried sputum. Tubercle bacilli exist wherever consumption exists, and are constantly being added to through the carelessness, ignorance, and helplessness of the consumptive. They are found in the dust of our streets; consider the enormous amount of expectoration constantly going on there, a certain proportion of which is tuberculous. On one side of a city street I counted 193 expectorations in less than an eighth of a mile; in another locality where fewer people pass I counted 211 in rather more than that distance. They are in our workshops and factories; in stores, banks, halls, hotels, school-houses, churches, theatres, street and steam cars, steamboats, and innumerable private residences. Wherever people congregate there are sure to be some persons, who, suffering from pulmonary tuberculosis, expectorate upon the floor, down radiators, upon their handkerchiefs, and in various places where the sputum will dry and set free the infecting germ.

The bacillus thrives especially in dark, damp localities, overcrowded and ill-ventilated rooms and halls; in tenement-house districts, where the air spaces are small, sunlight scarce, and ventilation poor. The bacillus is a very wily germ, and secretes himself in dark nooks and crannies for almost an indefinite period, until some disturbance, like the removal of a dusty garment or a piece of furniture or hanging, or sweeping, floats him in the air, where he is ready to infect the first person who approaches his vicinity presenting a favorable soil.

In investigating the etiology of the disease it is a frequent experience, especially among the poor classes, to obtain a history of intimate contact, often extending over months, with some other consumptive. It may be as caretaker, room-mate, fellow-worker in shop or factory, or wife, husband, brother, sister, or friend. Or, if not in contact with the consumptive himself, we may find that our patient has occupied a room where a consumptive has lived or died, and disinfection has been neglected or imperfectly performed. In all such cases the presumption is strong that direct infection took place through the bacilli scattered by the previous consumptive or the one intimately associated with.

Dust in unclean localities, in the streets of cities, in tenement-houses, on the wares of the fruit-vender's booth, upon the garments of second-hand clothes dealers, on the plush-covered seats of cars or the bedding of a sleeping-car, on the furniture and hangings of a room occupied by a consumptive, is always to be regarded as a possible source of tu-

berculosis. Says a writer,¹ "It would be difficult to conceive of a conjunction of circumstances more directly contributive to disseminate this disease, tuberculosis, than is offered in the palace-car." Let us take some illustrations of the foregoing statements: Prausnitz² inoculated guinea-pigs with scrapings obtained from railway coaches on the line from Berlin to Meran (a line much used by consumptives), and found that the scrapings from five coaches contained virulent tubercle bacilli. Petri³ has also proved the presence of tubercle bacilli in the dust of railway wagons. Dr. Hance⁴ examined the dust collected from street-cars, and proved the presence of tubercle bacilli by the inoculation of guinea-pigs. One in five cars examined was found dangerous to the health of the travelling public.

Schuirer,⁵ on rinsing the dust from some grapes which had been lying in a room looking out upon a narrow street where consumptives congregated to attend a clinic, noticed that the water was quite dirty. Injecting ten cubic centimetres of it into the peritoneal cavity of three guinea-pigs he obtained the following results: One died of peritonitis in two days; the other two lived forty-five and forty-eight days respectively. Post-mortem examination revealed tuberculosis originating at the site of inoculation and involving the peritoneum, liver, and spleen, with small deposits in the lungs. Microscopical examination revealed numerous tubercle bacilli.

Kirchner⁶ narrates the following fact: Three sergeants of a Prussian regiment employed in a portion of a warehouse containing clothing and military goods, successively contracted tuberculosis, from which all three died. Kirchner collected six specimens of the dust found upon the various articles of military clothing kept in the part of the warehouse where the sergeants were employed, and inoculated six rabbits with it, but with negative results. On repeating the test, however, with six more rabbits he obtained the following results: Three rabbits died of tuberculosis of the peritoneum in eighty-four, one hundred and one, and one hundred and eight days after the inoculation; two died of sepsis, and one remained alive, but his autopsy later showed no tuberculosis. He concludes from these experiments that the three soldiers contracted tuberculosis from the bacilliferous dust upon the clothing.

Of 311 animals inoculated with dust from rooms occupied by phthical patients by Cornet,⁷ 167 died soon after infection; 59—i. e., one-

¹ Sajous' Annual, 1890.

² Quoted in Sajous' Annual of Universal Medical Sciences for 1892.

³ *Revue de la Tuberculose*, II. 1894.

⁴ "A Further Study of Tubercular Dust," read at the New York Academy of Medicine, January 21, 1897.

⁵ Sajous' Annual, 1892.

⁶ *Revue de la Tuberculose*, 1896, No. 2, p. 142.

⁷ Annual of Universal Medical Sciences. Sajous, 1889.

fifth of the whole number—were found tuberculous, and 85 were healthy. A room in a hotel occupied for six weeks by a phthisical actress, and a workshop occupied by a tailor who had directly communicated the disease to a fellow worker, were found infectious. But in no case was the dust of the walls infectious when sputum-cups were used exclusively to receive the expectorated matter. The same negative results were also obtained in the City of London Hospital for Diseases of the Chest, the Adirondack Cottage Sanitarium, and the Winyah, at Asheville, by Drs. Heron, Hance, and Von Ruck, proper disposal of the sputum being made in all of these institutions.

Kirchner¹ also has shown by a series of experiments that persons who are in good health can be with the tuberculous, as parents, attendants, etc., without fear of becoming infected by bacilliferous dust, provided that the sputum and dejections are carefully collected and removed, and the receptacles serving for this purpose are scrupulously disinfected.

Miller² gives the following instance: "A lady, with her five daughters, four of whom were most of the time at school, took up her residence in a house in which, six years previously, there had lived a gentleman who had died of pulmonary tuberculosis but a short time after removing from the house. For the next six years the house was occupied by an old lady who died, but not from pulmonary tuberculosis. Within a year of moving into the dwelling the mother became tuberculous and died at the end of three years. During her illness the eldest daughter displayed symptoms and signs of pulmonary tuberculosis, and left home for six weeks, returning apparently well, and remained well thereafter. A few months after the death of the mother the second daughter, who had not long been away from school, displayed similar symptoms; but she also recovered after leaving home. Several years later the third daughter, soon after leaving school, presented consolidation at the left apex and died within a short time. Stained cover-glass preparations made from the dust obtained from the dining-room of the house in which the unfortunate family lived disclosed the presence of tubercle bacilli in considerable numbers."

C. O. Maish³ gives the following case: "A German, aged sixty-two years, weighing two hundred pounds, of good family and personal history, came to him in a state of advanced consumption. Two years before he had lost a son, aged twenty-three years, from the same disease. Three months later his wife, who had nursed the son, began to sicken. She was a German, aged fifty-nine years, strong, robust, and well preserved, weighing more than 220 pounds, with a good family history. She died within twenty months, having had frequent hemorrhages from the lungs and intestine and almost constant diarrhœa. Within five

¹ *Revue de la Tuberculose*, 1895, iii. p. 175.

² *British Medical Journal*, January 13, 1894.

³ *New York Medical Record*, October 13, 1894, referred to in *Sajous' Annual* for 1896.

months the husband was in the condition just described; while a daughter, aged twenty-two years, worn out from constant attention to the sick, was in a fair way to become phthisical, if not already so. It was learned that all three had expectorated on the walls, floors, and in the corners of the apartment, the man preferring to expectorate under his bed. The daughter slept in the same room with the sick man, and slept beside her mother during her illness."

From the *Traité de Médecine*, Charcot, vol. iv. p. 595, I cite the following case: In a small and ill-ventilated portion of a counting-house containing twenty-two employés, there came two tuberculous persons, coughing and expectorating often upon the floor. The employés came early in the morning to work, when the air of the place was charged with dust from the daily sweeping. Thirteen of them died from phthisis from 1884 to 1889. The contagion occurred very probably through the air holding in suspension the bacilli from the dried sputum on the floor. The small and badly-ventilated portion of the counting-house was abandoned, the floor destroyed, and the whole thing removed, and prophylactic measures instituted. Three years elapsed since this was done, and not a single new case of tuberculosis had occurred.

In asylums, prisons, and various other institutions where large numbers of human beings are kept in close contact, pulmonary tuberculosis is frequently the most common disease among the inmates and sometimes produces an almost epidemic mortality. "There are," says a report from the Illinois State Prison,¹ "1400 convicts within the walls, and fully one-third of them have consumption in a light or bad form. Nearly all deaths of persons in the penitentiary have been caused by consumption, and, as a rule, all 'long termers' either die within the walls from the disease or are pardoned out on account of it."

Baer and Cornet found that from 45 to 75 per cent. of all deaths in penal institutions were due to tuberculosis.² In the last report of the Taunton (Mass.) Lunatic Hospital for the year ending September 30, 1896, the Superintendent, in his report, says: "Seventeen died of phthisis, which was a large number, although the percentage of deaths from this disease was not greater than in many previous years. Most of the cases developed in the old part of the hospital, where the breathing-space is less and the overcrowding more apparent."

In a community of 400 Apache Indians, taken from a free nomadic life in Arizona and New Mexico and transferred to Alabama, where for four years they occupied log cabins badly constructed and situated in a low, damp hollow, and in which filth gradually accumulated "until they became veritable incubators of disease," the deaths from tubercu-

¹ Quoted by J. G. Hopkins, M.D., Thomasville, Ga., in "Contagiousness of Consumption." Reprint from the Journal of the American Medical Association, 1893.

² Flick: Medical News, October 21, 1893.

losis in five years were seventy-eight, or 43½ per cent. of the total number of deaths.¹

All this does not prove that the tubercle bacillus will infect every person brought within its influence, or, infecting them, will produce any injurious results; for in that case few of us would escape. The second factor must always co-operate, a favorable soil. The system must be in a receptive condition, which is generally, if not always, a depressed one; the "resistance potential" is low; and coincident with this there is often some defect in the respiratory passages or in the pulmonary tissue itself, which a bronchitis, pleurisy, influenza, or pneumonia may have caused. This matter of a favorable soil, however, will be discussed later.

Although, as I have said, the dried sputum is the principal source of the tubercle bacillus, there is also a very appreciable danger of contagion from food, especially from the milk and meat of diseased animals. This infection from food takes place principally through the alimentary canal, but it has also been found by Boullard² to occur through decayed teeth or an exposed cavity in the gum after a tooth has fallen out spontaneously or has been removed. An absorbing surface is presented affording lodgement for tubercle bacilli that may be contained in insufficiently cooked meat or other food. Starck,³ in examining 113 children with cervical adenitis, found that 41 per cent. showed the presence of carious teeth, and almost always the enlarged gland corresponded to the seat of the carious tooth. He mentions two cases of tubercular adenitis, in one of which numerous tubercle bacilli were found in two carious teeth, and in the other tuberculous granulations at the bottom of a carious excavation were discovered. Cadeac, of Lyons,⁴ has demonstrated by experiments on guinea-pigs that particles of food remaining in the tonsillar crypts conveyed tubercular infection to the ganglia of the neck. Although milk and diseased meat are the principal ingesta which convey the tuberculous infection, it is well to bear in mind that food in itself free from the germ may serve as a medium of contagion by bacilli brought to its surface through dust, as in the case of the grapes mentioned; through contact with contaminated tuberculous persons; or through the utensils with which it is prepared or served. Flies, also, which have had access to tubercular sputum, may do it, as the following experience of Hoffman, of Dresden, illustrates: Finding flies in a house where a patient had died of advanced tuberculosis, and whose sputum had contained great quantities of tubercle bacilli, he took them

¹ "The Vital Statistics of an Apache Indian Community," by W. C. Borden, M.D., Boston Medical and Surgical Journal, July 6, 1893.

² Annual of Universal Medical Sciences. Sajous, 1895.

³ Revue de la Tuberculose, 1896, July.

⁴ Lyon Médical, December 16, 1894, quoted in Sajous' Annual, 1896.

home and examined them. Tubercle bacilli were found in their intestines, at first in large and subsequently in smaller quantities. Their excretions, which covered the walls of the house in the form of numerous specks, also contained tubercle bacilli.

Tuberculosis is a comparatively common disease of cattle, and, as I have said, can be communicated to man through the milk and flesh. It is a danger always present and always to be taken account of, for these articles are universal staples of food. Villemin¹ states that 2000 bottle-fed babies die every year in Paris from tuberculosis.

Ollivier² reports the following experience illustrating the danger of infection from milk. "At a school for young girls there occurred within three months eleven cases of tuberculosis, of which five were fatal; and, with many, the site of the infection seemed to be intestinal. Two other pupils of the same school died of tuberculosis, in whom the family history and previous state of excellent health warranted the statement that they otherwise would not have been infected. Upon investigating the cause of this frightful occurrence, it was found that during this period the school had obtained its milk-supply from a cow which had shown, on post-mortem examination, advanced tuberculosis of the lungs and peritoneum, and more particularly of the udder."

As to the avoidance of this danger from tuberculous animals, it is possible, I believe, practically to abolish it by strict governmental and State inspection, which has already been instituted in many States, but often very imperfectly. All herds of cows kept for milk should be tested with tuberculin, which rarely, if ever, fails; and those animals reacting to this test should be removed from the herd, and either killed or kept apart for a time under observation. The Minneapolis Board of Health compels the farmers who supply that city with milk to test their herds with tuberculin. As there is less danger from the meat of tuberculous cattle³ than from the milk, less strict measures will probably suffice. Those that exhibit clinical evidence of tuberculosis should be killed; and those exhibiting suspicious signs of the disease should be tested with tuberculin, and if a reaction is obtained, they should be either destroyed or kept apart under observation for a time. If all animals slaughtered for meat are not inspected, or all meat exposed for sale is not, which would be the more perfect way, at least all suspected animals or those from suspected herds should be examined, the internal organs as well as the muscular portion. Milk-dealers should require those who supply them with this article to give proof that their cows have been tested with tuberculin and found to be free from tuberculosis. So long, however, as inspection is not absolute or complete, the

¹ Annual of Universal Medical Sciences. Sajous, 1890.

² Ibid., 1892.

³ "La Virulence des Viandes Tuberculeuses," par E. Leclainche, *Revue de la Tuberculose*, 2, 1894.

only safety is in boiling the milk, and a temperature of 167° has been found to destroy the bacilli.

In a recent article by L. Emmett Holt¹ the conclusion is reached, from the study of 119 autopsies of infants and young children, that infection through the alimentary canal is rare and will not explain more than 1 or 2 per cent. of the cases. In the vast majority, he thinks, the infection is through the respiratory tract. Granting this, the danger is always present that milk from an unknown source, such as is generally the case when it is exposed for sale in the small groceries, may be tuberculous, and the only safe rule is to boil it. The poor especially should be taught to do this. The well-to-do generally use either sterilized or Pasteurized milk for their bottle-fed babies. Why should one use raw milk any more than raw meat?

Roth² shows that butter can contain tubercle bacilli, and out of twenty samples purchased in the different Swiss Cantons two contained the bacillus. There is, he says, no way to destroy the germ in the butter. Our only safeguard, then, seems to be to use only milk from tested cows.

Tuberculosis can also be conveyed by the flesh of the fowl. Renzi³ says that he has not infrequently found evidence of tubercular disease in the abdomen of fowls; and instances are on record of infection produced in man by eating the flesh of tuberculous fowls. In Paris statistics have shown that it affects 23 per cent. of the poultry.⁴ Pork and the flesh of various other domestic animals has also been shown occasionally to contain tubercle bacilli.

The entrance of the tubercle bacilli through the skin, by means of a wound or abrasion, is a possible means of infection, although not a common one. The washing of infected garments, handkerchiefs, towels, bedding used by tuberculous patients, may infect the laundress if she happens to have or causes a break in the continuity of the skin on her hands or arms. Attendants upon consumptives may infect themselves by a wound from a broken cuspidor. A case is related by Harris and Beale⁵ of a cook who wounded one of her fingers with the fragments of a broken vessel containing sputum. Infection ensued, causing enlarged lymphatic glands in the elbow and axilla. The finger was finally amputated, the diseased tissue removed, and the glands extirpated, resulting in recovery. Physicians, surgeons, and medical students may become locally infected in making autopsies, in operations upon tuberculous bones, joints, and glands, and in anatomical dissections. Butchers and handlers of hides have also contracted it from tuberculous cattle.

¹ Medical News, December 12, 1896, p. 656.

² Corresp. für Schweizer Aerzte, September 1, 1894, p. 521.

³ Lungenschwindsucht, 1894.

⁴ "Animal Tuberculosos and their Relation to Human Tuberculosis," Nocard, 1895.

⁵ "Treatment of Consumption." Philadelphia: P. Blakiston, Son & Co., 1896.

Tuberculosis, like syphilis, has also been conveyed by the Jewish rite of circumcision, in which the operator frequently sucks the wound with his lips.

Dr. J. C. White ("An Etiological Puzzle," *Boston Medical and Surgical Journal*, December 5, 1895) speaks of a case of tuberculosis of the lobes of both ears. They had been bored by a woman who died soon afterward of consumption, and they were dressed by a sister who died soon afterward of quick consumption. They were also bathed with cow's milk after the operation. In some of these ways infection was produced.

He also mentioned a case of tuberculosis of the hands of a mother and daughter who had habitually washed the handkerchiefs and other receptacles of the sputa from a tuberculous father.

Fortunately, however, the infection has a tendency to remain localized. When one has much to do with tuberculous individuals, it is wise to protect all abrasions or wounds of the hands with collodion or in some other safe manner.

As there can be no tuberculosis without the specific bacillus, the great contest against the disease must be fought out with this micro-organism, and first it must be clearly understood that it is *possible* so to restrict the germ that in the future the disease may be as rare as it is now common. Since writing this last sentence I find the following corroborative testimony in a supplementary report of the New York City Board of Health, just published: "We fully believe that with proper regulation, tuberculosis may be restricted within the narrowest bounds, and eventually, perhaps, almost exterminated. This is not the idle dream of sanitary enthusiasts, but is a conviction founded upon the most thorough and conclusive experimental investigations, which have been amply confirmed by practical experience."

We have only to destroy the sputum, and the deed is accomplished, for from the pulverized sputum the majority of cases take their origin. Tuberculosis from other sources is so insignificant in comparison that we may almost disregard it. This seems to be, and is, simple enough, but its very simplicity leads to a disregard of the measures which accomplish it.

There are two principal ways in which we may set about it. First, compulsory notification, isolation, and disinfection, as in the case of other infectious communicable diseases, such as diphtheria and measles. Second, by the enlightenment of the public as to its danger and avoidance. This can be done by societies for the prevention of tuberculosis, like the one in Pennsylvania, by Boards of Health—State and city—by physicians among their clientage; by notices in all public places as to the danger of spitting upon the floor and wherever the sputum may dry; by instruction in schools; by the public press; and in any and all ways

by which the subject can be brought to the public notice. Compulsory notification already exists in some States and cities, as in Michigan, Buffalo, and quite recently in New York City. It is no new thing, for a hundred years ago the King of Naples issued the following decree :

“ Every physician is henceforth required to report to the authorities every case of consumption the instant it is recognized. Failing this, a fine of four hundred ducats (\$400 to \$900) will be exacted ; and for a second offence banishment for ten years. Poor patients shall at once be taken to the hospital. Their clothing and linen shall be kept and cared for apart from those of other patients, and an inventory be made. In case of death every article must be produced and identified by the hospital superintendent. Any infringement of this rule may be punished by imprisonment or the galleys. It is the duty of those in authority to renovate the room of a former patient—floor, hangings, and furniture coverings ; to burn the window-frames and doors, and replace them by new ones. The extreme penalty of the law will be visited on any one buying or selling the effects of phthisical patients. Every house where a consumptive dies shall be blacklisted.” If the danger from the sputum had been known, equally drastic measures would undoubtedly have been commanded regarding its destruction.

“ In Rome, at least, and I suppose throughout Italy, strict and rigidly enforced laws of notification and disinfection still exist. When a notification of a case of tuberculosis is received, the house is visited by a medical sanitary inspector. He gives complete instructions to the attendants or family. The attending physician is obliged to see that all handkerchiefs, night-dresses, bed-linen, etc., are thrown into a receptacle containing proper disinfectants. At regular intervals the disinfectors call and remove the soiled articles, thoroughly sterilize them, then wash them, and return them to the owners. This is done at the municipal expense in the case of poor people. Others pay according to their means. It is forbidden to wash any article belonging to a tuberculous patient outside of the lazaretto. All rooms which have been occupied by tuberculous individuals are cleaned and disinfected in the most thorough manner, and a record kept by the authorities of all houses in which tuberculosis has occurred, which can be consulted by those desiring to hire or buy a house.”—“ Public Health in Rome,” William G. MacDonald, M.D., *Boston Medical and Surgical Journal*, February 4, 1897.

The objections to compulsory registration are that the disease is slow and manifests great variations in its course, so that for a good part of the time the consumptive is able to be up and go about, and in many cases to pursue his usual vocation. To treat him, then, as a subject of contagious disease might isolate him to a certain extent and render it still harder to endure a lingering, painful, and, in many cases, hopeless disease. Another objection is that private business might suffer in

some cases, as, for instance, a tuberculous shopkeeper might lose his trade ; or tuberculous individuals, still able and obliged to work, might be thrown out of employment, and thus cause great hardship to themselves and family.

Properly conducted, however, I think registration would not in reality produce the undesirable results feared, or work any great hardship to the consumptive or his friends ; and, on the other hand, I believe it is fully justified, as a protective measure to the public exposed to an enormously frequent and dangerous infectious disease. As Bennett says,¹ "A diseased person in trying to save himself has no right to infect the sound public." Flick advocates registration at the breaking-down or infectious stage ; but this, I am inclined to think, is an unnecessary limitation, for the majority of the cases would be at this stage when they came to the notice of the physician. If one could always depend upon the physician to see that proper precautions were employed as to the disposal of the sputum and disinfection in his consumptive cases, registration might be less necessary ; but even physicians are sometimes careless, and in many cases a physician is only occasionally called in, or no physician is employed until late in the disease. Notification would simply mean that there was some responsible body who would see that the patient and his friends were advised as to the danger of communicating the disease and how to avoid it ; and further to institute proper disinfection of the room which the patient had occupied or in which he had died. I cannot see that he would be materially disturbed or in any way made an outcast, as some claim ; but, on the other hand, he would be assured that he was both protecting himself from reinfection and his friends and the public from infection ; for a consumptive and his room can be rendered harmless if the sputum is properly disposed of.

Dr. Irwin H. Hance, in a paper read before the New York Academy of Medicine on January 21, 1897, gives his experiments with dust collected in hospitals, dispensaries, tenement-houses, and public conveyances. Three out of four guinea-pigs inoculated with dust taken from a tenement-room in which a phthisical woman had lived and died, died of tuberculosis ; while four guinea-pigs inoculated with dust taken from a room where a patient with tuberculosis lived, but who observed the regulations of the Board of Health, showed no signs of the disease. He also found that in tenement-houses all the cleanly apartments were free from infection, thus proving "the wisdom," he says, "of granting the Board of Health power and authority to order such cleaning and renovation of tenements as is required."

For the poor, suffering from consumption, where preventive and dis-

¹ Sajous' Annual, 1890.

infectant measures are difficult or impossible of execution at their homes, on account of their poverty or ignorance, especial hospitals are needed where they can be isolated and kept from disseminating the disease as well as properly cared for. All civilized nations are now recognizing the importance and need of such institutions, and I have already noted the result of them in the case of England, where the mortality from phthisis has been reduced 50 per cent. in forty years. In the case of tuberculous individuals in the infectious stage, but still able or compelled to work, and to do so in close contact with others in shop, factory, or wherever they are a menace to those about them, I can see but one method to pursue—to remove them from their place of employment and either send them to a special hospital or a portion of a general hospital set apart for such cases, or give them a pension sufficient for their maintenance. If others are dependent upon them, some provision should also be made for them. It would, I am convinced, be economy for the State to do this, as it already does do in a similar manner in remunerating the owners of tuberculous cattle which it condemns. Moreover, the danger, I believe, warrants the step.

Innumerable sets of rules have been formulated for the disposal of the sputum and the prevention of the spread of the disease through the sputum, all essentially the same. The simpler and plainer they are, it seems to me, the better. I would venture to formulate the following.

How to avoid communicating consumption.

The expectoration—what is coughed up—contains the germs of the disease.

These germs will carry the disease *only* when the expectoration gets *dry*.

Only spit where the expectoration can be *destroyed* or kept *moist*.

Do not spit upon the floor anywhere, or in the street, or in the cars, halls, or in any vessel unless it contains water or a liquid disinfectant.

Always use a spit-cup when possible. If a paper cup is used, burn it every day, or oftener if there is much expectoration. If a glass or earthenware cup is used (a china coffee-cup will do) fill it half full of water, or a solution of carbolic acid, thirty drops to a pint of water. The cup should be thoroughly scalded with boiling water at least twice a day, and frequently boiled for half an hour.

Out of doors, where it is not possible to use a spit-cup, use pieces of cloth about ten inches square, handkerchiefs of cheap material or Japanese paper, and burn them as soon as possible. Do not allow the expectoration to become dry upon them, or use them more than once.

Great care should be taken that no particles of the expectoration lodge upon the hands, face, or clothing, or bed-clothing if in bed. If this happens they should be immediately washed off with hot water and soap.

The expectoration should not be swallowed.

The bed-clothes and linen of a consumptive should be kept separate, if possible, and boiled before washing.

Eating-utensils used by a consumptive should be washed separately, and, if possible, used by no one else.

A consumptive should sleep alone.

A consumptive should not work where he is compelled to handle the food or wearing apparel of others, or anything else which many others handle. If he is obliged to do this he should use every care to prevent any of his expectoration from getting upon his hands, upon the articles which he handles, or upon the persons upon whom he waits. He should not cough upon, or in the direction of, food or kitchen- or eating-utensils.

The living- and bed-room of a consumptive should be kept very clean and well aired, and should contain only the absolutely necessary articles of furniture. As much sunlight as possible should be admitted; and there should be constant ventilation night and day. A room with an open fireplace is to be preferred. There should be no dusting or sweeping, but a moist cloth should be used for cleaning.

A room that has been occupied by a consumptive, or in which a consumptive has died, should be thoroughly disinfected in the following manner:

Carpets, curtains, and bed-coverings should be exposed to superheated steam under high pressure, or where facilities for this do not exist, they, with all stuffed furniture, should be thoroughly shaken and brushed, and exposed to the open air and sunlight for several hours. The floor and walls of the room should be rubbed with new bread, followed by the application of a 1 per cent. solution of chloride of lime, or a corrosive sublimate solution (1 to 500); ceilings should be thoroughly dusted and white-washed. Every corner wherever dust is likely to lodge should be carefully cleaned. The windows should be left open for twenty-four hours. Prof. E. P. Pfuhl¹ has found that formaldehyde gas will readily destroy tubercle bacilli. This gas can be easily generated from methyl (wood) alcohol, and it would seem to be an efficient, cheap, and easy method of disinfecting a room and its contents without injury to them.² It would be a wise and economic step if town authorities should provide disinfecting apparatus, which could be used for other infectious diseases as well as tuberculosis.

"In Rome, Italy, after a death from tuberculosis the following is the method of disinfection: If the floor be carpeted, they first spray with corrosive solution, 1 to 500, combined with chloride of sodium, so that no dust may arise. Then the carpet is removed, the floor being continually

¹ Zeitschrift für Hygiene und Infection Krankheiten, xxxii. 339.

² Further experience has proved the efficacy of this method.

wet under it during the process of removal. If a bare floor exist, it is immediately drenched with a plentiful supply of 1 to 3000 corrosive, combined with hydrochloric acid. All carpets, bedding, mattresses, portières, curtains, clothing, or anything of like nature are rolled up in sterilized sheeting and removed, to be treated in steam sterilizers. The walls are then thoroughly drenched with corrosive, 1 to 500, and chloride of sodium. This drenching is done with a small hand-pump. After the drenching a vigorous scrubbing takes place, and, if need be, a vigorous scraping, too. Each chair is taken to the tub and thoroughly scrubbed with the solution. Stuffed furniture is treated with the corrosive and sodium solution, which they consider harmless. Metal articles, such as brass beds, are rubbed over with a phenic-acid solution. Water-closet bowls are swabbed out with slaked lime. Landlords are then obliged to paint, paper, and whitewash the rooms at their own expense."—"Public Health in Rome," William G. MacDonald, M.D., *Boston Medical and Surgical Journal*, February 4, 1897.

In schools, teachers should admonish the scholars as to the danger of spitting upon the floor, and cuspidors should be provided.

Spittoons, says Cornet, and the writer agrees with him, should be placed wherever it appears necessary, in every enclosed space frequented by men; in hotels, restaurants, places of amusement, workshops, factories, counting-houses, corridors, stair-landings, railroad stations, steam-cars, street-cars, steamboats; and on the wall near each spittoon there should be a notice: "Spittoon for those troubled with cough or who have to spit. Spitting on the floor is dangerous and the means of carrying disease." These spittoons should be eight to ten inches in diameter, two inches high, smooth, slightly inverted edges, made of strong, smooth glass, porcelain, earthenware, or enamelled iron, and should contain water to the depth of half an inch.

In medical out-patient departments of hospitals and dispensaries, circulars with plain, simple directions as to the avoidance of tuberculosis should be given each patient, and to the tuberculous ones, in addition, rules for disposing of the sputum. In the waiting-rooms of these institutions spittoons should be provided, and notices as to the danger of spitting on the floor posted. Dr. Hance¹ has demonstrated the existence of tubercular dust in the waiting-room of a dispensary. Street-cars are now beginning to have notices posted in them forbidding spitting. The following is the one seen in the Boston cars:

"Health Department of the City of Boston, October 13, 1896.

"The Board of Health hereby adjudges that the deposit of sputum in street-cars is a public nuisance, source of filth, and cause of sickness, and hereby orders that spitting upon any floor of any street-car be, and hereby is, prohibited."

¹ Loc. cit.

A shorter and simpler one would seem preferable for accomplishing the object, when one considers the various nationalities who travel in the cars, and their limited knowledge of English.¹

The cleansing of all places where many people congregate should be thorough, and dry sweeping abandoned. Especial and thorough disinfection should be practised, at the end of the season, in hotels at health resorts frequented by phthisical patients, and at frequent intervals in cars where such patients travel, as on some of the Southern routes. Petri² and Prausnitz,³ in experiments upon the disinfection of railway carriages, found that simple washing with soap and water was quite efficacious.

The streets of cities and in thickly settled portions of towns should be kept well watered and dust not allowed to blow about, as one often sees it in the wake of a horse-sweeper. Sweepings from shops and stores should not be thrown into the streets.

If these various measures were rigidly observed, there is no doubt that a constant and marked diminution of the disease would be quickly observed; indeed, facts have already proved this to be so, for since 1887, when the German authorities instituted prophylactic measures, the mortality from the disease in Prussian prisons, for instance, has steadily diminished. Before these measures the deaths per 10,000 inmates from tuberculosis were 118.9 from 1875 to 1876; 140.8 from 1878 to 1884; 174.7 from 1884 to 1887. After the prophylactic measures 101 from 1887 to 1890; 89.4 from 1890 to 1892, and only 81.2 from 1892 to 1894. In Prussia from 1875 to 1886 the general mortality from tuberculosis was more than 30 per 10,000 inhabitants; since the application of prophylactic measures it has fallen below 25, and a similar diminution is noted in other German States.⁴

THE FAVORABLE SOIL. We come next to the consideration of the *favorable soil*, which must exist conjointly with the bacillus in order to produce the specific infection. Exactly what constitutes this receptive state it is difficult to say, but we may define it in general as a condition of health below the normal standard, either temporary or chronic, with a coexistent, weakened pulmonary tissue. If we do not always know precisely the physical state which offers the favorable soil, we do know innumerable conditions which experience has proved to be conducive to it, as well as innumerable causes which produce these conditions—causes existing or developed either in the individual or in his environment.

(a) *The individual.* Regarding inheritance, most authorities now agree, I think, that only a *tendency* to the disease at the most is meant

¹ Since writing the above a simple statement that spitting is prohibited under a penalty of \$100 has been substituted.

² *Revue de la Tuberculose*, 1894, p. 16.

³ *Deutsche medicinische Wochenschrift*, June 12, 1894.

⁴ Cornet: *Le Bulletin Médical*. Paris, May 26, 1895.

by the term ; and the facts are ostensibly in accord with this interpretation of the word. Genuine, direct inheritance of the bacillus from the mother to her infant has been proved to be possible, although exceedingly rare. I am obliged to express serious doubt, nevertheless, that even a *tendency* is inherited. It seems to me that the apparent fact is explicable thus : descendants of consumptives are very frequently born with lowered vitality, poor physical development, and a lack of vigor, constituting a diminished "resistance potential." This condition is often still further accentuated by the mode of life followed. From the very fact that there is a lack of muscular development and vital force, a sedentary, indoor occupation is naturally chosen, which still further depresses the system and weakens the pulmonary tissue as well as increasing the opportunities of bacillary infection. Let the same conditions exist in one not born of consumptive ancestry, and I believe there would be as great a likelihood of contracting the disease as in the former case. In an analysis of 100 city men of various occupations I obtain the following suggestive results :

Sixty-two of indoor occupations had fathers of indoor occupations also.

Sixteen of indoor occupations had fathers of outside occupations.

Six of outdoor occupations had fathers of indoor occupations.

Sixteen of outdoor occupations had fathers of outdoor occupations.

Thus is shown the strong tendency from the more wholesome outdoor life to the less wholesome indoor.

On the other hand, given a strong, robust individual, well developed, and of good vitality, born of consumptive ancestry—a condition not infrequent—and I believe he is no more likely to suffer from pulmonary tuberculosis than one of like physical condition born of parents with no phthisical taint in their ancestry. At least, there is no doubt in my own mind that many cases of consumption attributed to inheritance are in reality caused by the same vicious conditions under which the parents lived and by the greater opportunity of exposure to the bacillus. This, I think, is at least a partial explanation of the large number of cases of apparent inheritance (107 out of 232) in the analysis of the 232 hospital cases (vide table). Of course, many other causes also incident to their mode of life and occupation played an important rôle in causation.

Granting an inherited tendency, it is but small. Edward Squire, of London,¹ made an analysis of 1000 cases, and concluded that the influence of heredity could not be placed higher than 9 per cent of cases among children of phthisical parents in excess of the cases occurring among the children of non-phthisical parents. He also continues to say

¹ *Lancet*, December 15, 1894.

that hereditary influence in phthisis is not a true heredity, but a tendency to suffer from disease—tuberculosis among other complaints—which the offspring of phthisical parents has in common with the children of weakly parents, from whatever cause this delicacy may arise. The children of phthisical parents contract the disease earlier because they are exposed to the infection at home. The family house and its surroundings are, therefore, much more dangerous than the pedigree.

In the 2700 young men I examined (*vide table*) but 5.9 per cent. had lost one or other parent from consumption. I must confess myself, then, from the foregoing reasons, quite in accord with Whittaker's conclusions that "The idea of a predisposition is dangerous, because it removes attention from the avoidable sources of the disease. It is unsatisfactory, because it does not prove enough. It is also undemonstrable, and the experiments made to prove it are all open to objection. Finally, it is superfluous."

But whatever may be the family history, every person of imperfect muscular development, low vitality, and deficient respiratory capacity—all indicating a diminished "resistance potential"—is a possible candidate for the bacillus, and should receive especial training and attention to remedy as far as possible this congenital or acquired condition. From a child up, he should be carefully watched. If his mother is a consumptive, she should not nurse him. Nutrition, respiration, exercise, rest, clothing, fresh-air supply, and place of abode should all receive careful attention. Such a person should live an outdoor life so far as possible.

Whenever, in the remote past, pulmonary tuberculosis first originated it was probably coincident with the building of closed places of abode, for it is, for the most part, a disease of indoor life; and this fact cannot be emphasized too strongly in all discussions upon its prevention. We seem to have reversed the natural order of things, and instead of regarding indoor life the exception, we make it the rule. Even when we transfer ourselves from one abode to another we do not enjoy the fresh air in transit as we often might, but enter a closed vehicle, like a street-car, almost invariably filled with impure air and foul smells. We have grown so accustomed to this abnormal life that its dangers are lost sight of, but they are not the less real, and especially menace those of deficient vitality whom we have been considering. For them, at least, outdoor life and occupation is most desirable.

Of the many predisposing causes existing or developed in the individual we have, first in importance, malnutrition and defective assimilation, and these again are produced by a variety of causes; dyspepsia is a common one. As some one has said, "Stomach troubles are power-

¹ An American Text-book of Therapeutics, 1896.

ful predisposing causes of tuberculosis." Of the 2700 young men I examined, dyspepsia was complained of in about 15 per cent. Insufficient and improperly cooked food, rapid eating or eating when exhausted, decayed teeth or absence of teeth, irregular habits, lack of or insufficient physical exercise and fresh air; intemperance in eating and drinking are all causes of dyspepsia, and their mention suggests the remedy. Good teeth are a very valuable safeguard against pulmonary tuberculosis, and free dental hospitals or clinics for the deserving poor, as advocated by Dr. R. C. Newton,¹ would, I believe, remove a not insignificant factor in the causation of the disease among this class of people. The custom now so largely prevalent of protecting the first dentition until the second arrives is undoubtedly a valuable means of protection against the entrance of the bacilli through a carious cavity or a cavity from which a tooth has been extracted, which is a real danger, as I have shown above.

Dyspepsia, moreover, is often the direct prelude to phthisis, and when accompanied with loss of weight and appetite, a quickened pulse, and, perhaps, a slight rise of temperature, an examination of the lungs ought always to be made, and the individual kept under careful observation. I vividly recall the case of a young woman who consulted me for what apparently seemed to be a case of ordinary dyspepsia, and in whom I neglected to make a physical examination of the lungs. She developed phthisis subsequently, of which she died. In such cases a spirometric test is of value, as advocated by Otis.² Anæmia, which is also a result of dyspepsia, as well as various other depressing conditions, is a prolific predisposing cause, and its origin must be sought for and remedied. Indoor life, insufficient rest, deprivation of sunlight, exhausting discharges, irregular habits, and worry are some of its causes. Intemperance in alcohol, especially among the working people, is another frequent cause. In the 232 consumptives treated in the hospital (vide table at end) I obtained a history of alcohol to excess in ninety-five. Probably the alcoholic habit was accompanied in most of the cases by irregular habits and exposure which intensified its injurious influence, as in the case of teamsters, who contributed 6 per cent. in the above number of consumptives.

All exhausting discharges, particularly leucorrhœa, menorrhagia, excessive lactation and rapid child-bearing, sexual excesses, depress the system and lower the "resistance potential." Amenorrhœa is frequently a danger-signal and evidence of that anæmia which precedes the tubercular outbreak. Imperfect convalescence from pneumonia, pleurisy,

¹ "What Shall be Done for the Teeth of the Poor?" Read before the New Jersey State Dental Society, August 3, 1895.

² "Some Methods of Chest Examination Supplementary to Auscultation and Percussion." Reprint, 1895.

bronchitis, influenza, or diphtheria leaves the pulmonary tissue in a particularly susceptible condition, and the general system in a depressed state. Respiratory gymnastics are of great value in these cases, to which I shall refer again in speaking of respiration. The childhood diseases of whooping-cough, measles, and scarlet fever are also frequent predisposing causes, and very much in the same way as the cases of imperfect convalescence. Strictly enforced notification laws, isolation, thorough disinfection will best reduce this danger, and we ought to consider it the exception for a child to contract any of these diseases, instead of the rule, as is too much the case now. The present system of daily school inspection by a health officer, practised in some of our cities, is a valuable preventive measure.

The so-called "neglected cold" is often adduced as a frequent exciting cause of pulmonary tuberculosis, and when one considers the number of colds the community suffers from in this climate, such would seem to be the fact. In the 2700 men examined, 41.4 per cent. complained of colds in the head or throat; and in the 232 consumptives, seventy-nine attributed the exciting cause to a cold. The underlying cause, however, is to be sought for. What causes the colds? Impure air, dust, extreme and sudden alternations of temperature, excessive indoor temperature, dry heat, lack of physical exercise and inadequate respiration, neglect of daily cold bathing of the throat and chest, an excessive amount of clothing, insufficient sleep and rest, mouth-breathing, excess in eating and drinking, constipation. These neglected colds, or frequently recurring catarrhal affections, whatever the underlying cause, "may form predisposing causes," says Webber,¹ "either by producing sore places in the mucous membrane and thus allowing the bacilli to settle, or by weakening the epithelial cells of the mucous membrane and their ciliary action, or by causing imperfect breathing from unconsciously avoiding deep inspiration in order to avoid coughing, or by weakening the nutrition and energy of the whole system."

The treatment is not by futile attempts to avoid exposure, and by indoor coddling, but by hardening, exposure to the outdoor air in almost all weathers, free ventilation when indoors, sponging the chest and throat with cold water every morning, woollen underclothing of moderate thickness, physical exercise out of doors and in the gymnasium.

The nasal cavities, post-nasal spaces, and tonsils are all possible sources of infection. Dieulafoy² took fragments of hypertrophied tonsils and adenoid vegetations and injected them into guinea-pigs. Out of sixty-one hypertrophied tonsils he found eight tuberculous, and in thirty-five cases of adenoid vegetations seven were tuberculous. Strauss³ has shown the presence of tubercle bacilli in the nasal cavities of healthy

¹ "Chronic Pulmonary Phthisis," 1885.

² *Revue de la Tuberculose*, vol. III., 1895.

³ *Revue de la Tuberculose*, vol. II., 1894.

individuals associating with consumptives more or less constantly as attendants, nurses, etc. (presumably when the sputum was not properly disposed of). In twenty-seven well persons nine were found to have virulent tubercle bacilli in their nasal cavities. So long as the nasal epithelium remains intact the bacilli are harmless, and we have what M. Verneuil called "latent microbism." If, however, the epithelial barrier is broken through, the microbism may become an active one, as Louis has shown in the case of young subjects who have become tuberculous after repeated attacks of epistaxis.

Whenever, then, hypertrophied, spongy tonsils or adenoid growths exist, as they so frequently do in children, they should be removed; not only, as has just been shown above, do they offer a favorable soil for the bacillus, but, also, by partially occluding the upper respiratory passages, interfere with full free respiration, and so diminish the lung capacity and limit chest expansion. The so-called "chicken-breast" is not infrequently the result of such obstruction. The anterior nasal passages should also be kept freely open, and any defect in the physiological action of the mucous membrane—hypertrophy or atrophy—remedied.

Enlarged cervical glands, a very common occurrence in childhood, and from a variety of causes, are in a certain proportion of cases tuberculous, as is illustrated in the case of the carious teeth I mentioned earlier in the paper. Valland¹ maintains that tuberculous infection of the lungs in later life is secondary to tuberculosis of the lymph-glands in childhood, and in 101 out of 108 tuberculous individuals he found enlarged cervical glands. Among 2506 persons examined, enlarged cervical glands were found between the ages of seven and nine in 96 per cent.; between ten and twelve in 91.6 per cent.; between thirteen and fifteen in 84 per cent.; between sixteen and eighteen in 69.7 per cent.; between nineteen and twenty-four in 68.3 per cent. Tubercle bacilli were found in the cervical lymph-glands in about 68 per cent. of adults.

Enlarged cervical glands are always a menace to the individual both from the possibility that they may be tuberculous, or become so, and from the depressing effect upon the general system, particularly if they break down and suppurate. They may be caused by carious teeth, hypertrophy of the tonsils, purulent otitis, eczema of the head, irritation from pediculi capitis, adenoid vegetations, and other irritative causes. They are also common in children, apparently as a local manifestation of an anæmic condition resulting from malnutrition and an unhygienic environment. They are to be treated generally and locally. All sources of irritation are to be sought for and removed. If the glands are few, or

¹ Annual of Universal Medical Sciences. Sajous, 1895.

there is but a single one, and their position and depth render their removal a comparatively simple operation, I should advise total extirpation. I have had most satisfactory results from this procedure. In non-suppurating glands Ingals, of Chicago,¹ suggests the injection of lactic and carbolic acid, from 15 to 40 per cent. of the former and 2 to 5 per cent. of the latter, and he narrates a successful case from this treatment. If there is suppuration, the gland can be thoroughly scraped out, as advised by Mr. Treves, or drained with a Briggs' canula; or it can be drained through a small opening, washed out with peroxide of hydrogen, and the cavity filled with iodoform emulsion. External applications have proved almost, if not quite, useless in my hands. For general treatment, good hygiene, pure air, sunlight, nourishing food, iron, arsenic, and cod-liver oil. Experience has proved that sea air and bathing are most beneficial in such cases; hence the many sanatoria in Europe, on the coasts, for strumous children.

An unstable nervous state or a depressed nervous tone interferes with the healthy normal functions of the body, and so reduces its "resistance potential." Loss of sleep, or frequently interrupted sleep, worry, despondency, disappointment, long or extreme mental application, all depress the nervous system. When one is obliged to be much with the disease, and long at a time, great care should be taken to maintain the nervous system in a normal condition by an abundance of sleep in a well-ventilated room, sufficient exercise and change, and freedom from worry and other depressing influences.

It is noways unlikely, it seems to me, that too much and too heavy clothing has been one of the predisposing factors to the disease far more frequently than insufficient clothing. The old idea is still commonly entertained that a consumptive must be smothered in clothing and incarcerated in a tight, superheated room. The neck-muffler and chest-protector are still in common use. The only safety for weak lungs is to develop and strengthen them by use in pure, out-of-door air, and to promote a vigorous condition of the whole body by exercise, cold bathing, and exposure in the air; heavy clothing and inactive indoor life only increase the existing local and general weakness. Woollen under-clothing is advised, for it preserves an equable skin temperature better than other fabrics; but it should not be too thick or heavy. The garments should be loose, and for women the "Flynt waist" is admirable. Cold bathing, to which I have just referred, is useful in giving tone to the nervous system, as well as promoting the activity of the skin. It plays an important rôle in the treatment of tuberculosis in all the European sanatoria. It can be applied in various ways: the simple sponge bath, either of the entire body or of the chest and neck; the

¹ Transactions of the American Climatological Association, 1896.

² Ibid., 1896.

spray needle, or shower bath, and the wet-pack. It is well to gauge accurately the temperature of the water by the thermometer. Public baths in the larger cities of this country are becoming more common, an admirable example of which is the one recently erected at Brookline, Mass., with its swimming-tank eighty feet in length. These, together with improved construction in tenement-houses and stricter factory inspection, increase the "resistance potential" in the poor and help to establish individual immunity. The air-bath and sun-bath are also valuable supplements of the water-bath, or can be used alone.

Inadequate and partial respiration is, I am convinced, a frequent predisposing cause of tuberculosis, and also a very common condition. Not only is the resisting power of the lung tissue diminished, but the aëration of the blood, upon which depend so largely all the vital processes, is imperfectly performed. Full and free respiration strengthens the pulmonary tissue, increases its vitality, and consequently its "resistance potential." By a habit of full and deep breathing, once established and persisted in daily, "one is fortifying himself," says Otis,¹ "against the possibility of disease of the lungs by thus maintaining the pulmonary tissue in an active, healthy, and well nourished condition; and there is no portion of the apices which, from insufficient use and poor nourishment, is a menace to the individual by offering a fitting soil to a wandering bacillus. In convalescence from pneumonia and pleurisy with effusion, the importance of expanding and revivifying, as soon as possible, the lungs whose functional capacity has been diminished and whose nutrition has been depressed, can hardly be overestimated." The especial respiratory exercises are simple and yet efficacious—standing erect and making long, deep inspirations and slow expirations; combining the arm movements with the respiratory act by raising them to a horizontal position, and then over the head until the hands meet, slowly and deeply inspiring while performing the movement, and expiring while lowering the arms; raising the arms and carrying them back and down, describing a movement of circumduction; extending the arms in a horizontal position and bringing them forward and then sharply back. Then there are various exercises with wands, and if one has access to a gymnasium, the various devices there for increasing the lung capacity and developing the respiratory muscles, the "chest developers," "lung expanders," quarter circle, or many of the heaving movements of the Swedish system. Of course, there is an infinite variety of general exercises which produce a more energetic respiratory activity, such as swimming—most excellent for increasing the lung capacity—skating, tennis, running, jumping, bicycling, rope-jumping, hill-climbing, dancing, and the like.

¹ "The Value of Respiratory Gymnastics," etc. Boston Medical and Surgical Journal, May 28, 1896.

(b) *The environment.* In the question of environment and the part it plays in the causation of tuberculosis there enter various considerations: the climate, one's abode and place of occupation, character of the soil and subsoil, drainage, ventilation, opportunities for light and sunshine. I do not believe that climate directly plays an important rôle in the causation of phthisis, although it is a most potent factor in its treatment; for the disease, as I have said, exists in every climate, from the Arctic zone to the tropical regions. Indirectly, however, its influence is felt, when, for instance, on account of its severity, one is compelled to live indoors a large portion of the year, for indoor life has its especial dangers, as all artificial life does. When one can choose the situation of his abode, it should be upon a dry foundation, either naturally so or made so by drainage, for soil and subsoil dampness has been shown to be a potent predisposing factor. In Salisbury, England, the mortality from phthisis was reduced 50 per cent. by deep and thorough drainage of the subsoil.¹ The construction of the dwelling should be such that an abundance of light and sunshine can enter; sunshine is one of the best bacillicides. A supply of fresh air and the escape of foul is also to be provided for. When the rooms are small, either in a dwelling or shop, if a constant current of air is maintained, the living conditions will be wholesome. Especially necessary is it that sitting and sleeping rooms should have constant and thorough ventilation, and this can often be attained by some of the simple means of window ventilation in conjunction with an open fireplace. Night air is not only *not* injurious, as many think, but, on the contrary, it is often purer than day air, which contains more dust from the movements of the various day activities. In the majority of cases, for a dwelling-house, the best combination for ventilation and heating is probably the hot-air furnace and the open fireplace. (With the increasing interest in tenement-house reform, the erection of model structures of this class will insure to the poor, it is to be hoped, adequate provision for ventilation, cleanliness, and light. Back-to-back tenement houses on narrow, dark alleys or "places" are prolific breeders of phthisis, not only by disseminating tubercle bacilli, but by preparing a favorable soil for them. It is well to recall Trudeau's noted environment experiment here. He inoculated a number of rabbits with the same quantities of tuberculous virus. Half of them were allowed to run free in the open air, and the other half were placed in a dark hole under ground. They were all killed at the same time. Those which had run free had either recovered entirely or showed only localized lesions, while the other half showed wide dissemination of the disease. In workshops and factories careful and frequent inspection should require proper ventilation and

¹ Ransome: "The Treatment of Phthisis," 1896.

freedom from dust. In churches, school-houses, theatres, libraries, public halls, reading- and recitation-rooms, where inadequate ventilating facilities or neglect of their use are so common, the remedy must come both by educating the people as to the dangers of impure air and by municipal or town inspection and control. If it is considered necessary to detail an officer at any assembly to see that order is maintained, at least equally important is it for the well-being of the assembled crowd to have an inspector on hand to see that they breathe pure air. How common an experience it is to find a country church filled with a drowsy audience, breathing foul and stagnant air, while the pure winds of heaven surrounding it on all sides are sighing for entrance. As Ransome¹ well says, "The ventilation of ball-rooms, concert-halls, theatres, and places of worship is a scandal to civilization."

I have frequent occasion to pass through a large reading-room, invariably redolent of stale and malodorous air, where no apparent means of ventilation exists or is thought of, although thousands of dollars have been expended upon abundant and varied literature, probably containing among it excellent treatises upon ventilation. What better arrangement for cultivating a favorable bacilli soil!

In cities and large and thickly settled towns, it is of vital importance that there should be abundant and ample air spaces, by wide streets and frequent small parks. Narrow and blind alleys, which do not allow a sweep of air through them, and act as cul-de-sacs for stagnant, impure air, ought not to be allowed. Steam-cars and street-cars in the winter in this climate are generally almost hermetically sealed, and every one is familiar with the evil odor of foul air which greets him on entering a street-car from the outer pure air. It seems well-nigh hopeless to convince the average traveller that air breathed and rebreathed is more dangerous by far than cold air or draughts. The remedy must come through the management of lines of travel and the slow enlightenment of the travelling public. Who ever thinks to inquire whether a steam or electric car is thoroughly aired out after a journey before beginning another?

One's occupation, as well as the conditions under which it is pursued, may be a predisposing cause of tuberculosis, by directly weakening the lungs as well as the general health. Those employed where there is much dust, such as stone-cutters, knife-grinders, potters, dyers, wool-carders, cigarmakers, polishers, and the like, especially when the work is carried on in confined spaces, have always suffered a large mortality. Dr. Greenhow calculated² that 45,000 deaths occurred annually among those thus employed in England and Wales, and he believed that the whole of this mortality was preventable by the introduction of better methods of ventilation and working.

¹ "The Treatment of Consumption," 1896.

² J. Edward Squire: "The Hygienic Prevention of Consumption," 1893.

Printers, compositors, tailors, dressmakers, bakers, and those who work in ill-ventilated, poorly lighted, and damp places, or where smoke and various irritating gases are generated, contract phthisis readily. Teamsters are also frequent sufferers from the disease, probably from their irregular life and alcoholism.

The only way of reducing the mortality from these unwholesome occupations is to make the hours of labor short and the conditions under which they are pursued as favorable as possible. There should be rigid State inspection of all places where they are followed. Sufficient air-space and ventilation should be required; every means known to dispose of the dust, and, if necessary, respirators should be provided for the workmen.

I have endeavored in the above, with more or less completeness, to portray the causes and conditions of pulmonary tuberculosis; the danger from the tubercle bacillus on the one hand, and from a diminished "resistance potential" on the other. I have also indicated the means of prevention. When one considers the almost innumerable number of these causes which promote a tubercular state he may well be appalled, and feel inclined to abandon all attempts at prevention as hopeless. On the other hand, however, what has already been accomplished, as I have shown above, encourages one to continue the struggle and increase his exertions against this most destructive disease of modern times. To restrict the spread of the specific micro-organism and to fortify the body against its insidious influence, and increase the "resistance potential," are the two simple lines along which we are to advance in the contest. I firmly believe that it is possible, by a union of all the resources at hand—State and law, individual and organized exertions, enlightenment of the public as to the dangers of the dried sputum and their avoidance, and a utilization of all the means at our command to increase the general average of health—so to reduce the mortality from consumption that it may become one of the rarer diseases instead of the most common and fatal, as now. The medical profession has labored long and painfully, and with lamentably little success, in its attempts to cure the disease or discover a specific for it. Let it now turn its attention to prevention and enlist the public in its endeavors. The outlook is infinitely more hopeful in this direction; and prevention, whether one is dealing with crime, poverty, or disease, is better and more scientific than attempt at cure.

TABLE I.—ANALYSIS OF 232 HOSPITAL CASES OF PULMONARY TUBERCULOSIS TAKEN CONSECUTIVELY.

(Omitting a few cases in which no sufficient history could be obtained.)

Number of males	152
Number of females	80
Married	26
Single or unknown	54
Occupations of men :	
Indoor	91
Outdoor	53
Unknown	8
Occupations of women :	
Domestic or housework	47
Special occupations :	
Printers	5
Teamsters	14
Stone-cutters	9
Factory operatives	10
Dusty occupations	39 +
Laborers or other unskilled work (not incl. teamsters)	45
Skilled workers (generally indoor)	79
Father, mother, brother, or sister (one or more) died of pulmonary tuberculosis in	107
Out of 145 cases (in which some record was attempted, though imperfect) a history of continued intimacy as caretaker, wife, husband, etc., was given in	23
Alcoholics	97
Exciting causes given :	
Result of pleurisy	11
" " pneumonia	14
" " grippe	13
" " cold	79
" " hæmoptysis	15
After miscarriage or childbirth	6
Began with "cough"	47

TABLE II.—EXAMINATION OF 2700 APPARENTLY WELL YOUNG MEN.

	Per cent.
Complained of cold in the head or throat	42.6
" " dyspepsia	14.85
" " bilious attacks	10.96
" " habitual constipation	7.63
" " shortness of breath	9.2
Had had bronchitis	6.1
" " pneumonia	5.0
" " pleurisy	1.0
" " enlarged glands in the neck	3.5
" " spitting of blood	1.3
One parent had died of consumption in	5.9
Both parents had died of consumption in	0.2



The Medical News.

PUBLISHED WEEKLY, AT \$4.00 PER ANNUM.

THE practitioner who would give his patients the benefit of the latest and best knowledge, and thus most certainly ensure his own success, cannot afford to neglect the medical weeklies. Foremost among them, as well as cheapest, stands *THE MEDICAL NEWS*. Its 32 quarto pages of reading matter provide space each week to lay before its readers the latest advances in medicine, surgery, obstetrics, and the various specialties. This vast range of information is gathered from the whole civilized world by the perfect organization of *THE NEWS*. Its reputation brings to it the contributions of recognized leaders of medical thought and practice. It is a marvel of modern times that the immense body of the world's advancing knowledge in medicine can be laid each week upon the table of the subscriber at the comparatively trivial price of \$4 per annum. The secret of course lies in a circulation embracing the most progressive men in the United States and Canada as well as in many foreign countries.

The American Journal of the Medical Sciences.

PUBLISHED MONTHLY, AT \$4.00 PER ANNUM.

BEING the medium chosen by the best minds of the profession during seventy-eight years for the presentation of their elaborate papers, *THE AMERICAN JOURNAL* has well earned the praise accorded it by an unquestioned authority—"from this file alone, were all other publications of the press for the last fifty years destroyed, it would be possible to reproduce the great majority of the real contributions of the world to medical science during that period." Original Articles, Reviews and Progress, the three main departments into which the contents of *THE JOURNAL* are divided, will be found to possess still greater interest than in the past. The brightest talent on both sides of the Atlantic is enlisted in its behalf, and no effort will be spared to make *THE JOURNAL* more than ever worthy of its position as the most useful and valuable of medical magazines.

The Medical News Visiting List for 1898

THIS favorite list is now published in four styles: Weekly, dated, for 30 patients; Monthly, undated, for 120 patients per month; Perpetual, undated, for 30 patients per week per year, and Perpetual, undated, for 60 patients per week per year (without text). The first three styles contain 32 pages of text and 160 pages of blanks. The 60-patient style consists of 256 pages of blanks. Wallet-size, flexible leather cover, pocket and pencil. Price, in any style, \$1.25. Special Rates below. Thumb-letter Index, for rapid use, 25 cents extra.

The Year-Book of Treatment for 1898.

An Annual Summary of Real Advances in all Departments of Medicine and Surgery. 12mo., 500 pages, \$1.50. Ready early in 1898.

SPECIAL COMBINATIONS AT REDUCED RATES.

THE AMERICAN JOURNAL, \$4	TOGETHER	
THE MEDICAL NEWS, \$4	\$7.50	
THE MEDICAL NEWS VISITING LIST, \$1.25		
WITH JOURNAL \$4.75; OR NEWS \$4.75; OR BOTH \$8.25		
THE YEAR-BOOK OF TREATMENT, \$1.50		
WITH JOURNAL \$4.75; OR NEWS \$4.75; OR BOTH \$8.25		
		JOURNAL, NEWS, VISITING LIST AND YEAR-BOOK \$8.50

LEA BROTHERS & CO., PUBLISHERS, { 706, 708 & 710 Sansom St., Philadelphia
111 Fifth Ave. (cor. 18th St.), New York.

3 2044 004 387 395

This book should be returned to
the Library on or before the last date
stamped below.

A fine is incurred by retaining it
beyond the specified time.

Please return promptly.



